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ABSTRACT

This study of factors used by graduate faculty in their evaluation of graduate students had as its goal the development of a research-based conceptual framework of desired outcomes in graduate education. Factor analysis of the responses of 190 graduate faculty at Kansas State University, Manhattan, to a graduate student performance checklist produced 20 factors interpreted as desired outcomes of graduate education. The first five were labeled Personal and Interpersonal Development, Analysis and Synthesis, Scholarly Productivity, Persistence, and Communication. Significant differences were identified between the scholarly divisions on nine factors used in evaluation and between professorial ranks on two factors. (Author)

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BEHAVIORALLY-REFERENCED FACTORS USED IN GRADUATE STUDENT EVALUATION

a summary of research conducted by

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This research attempted to address the criterion problem in graduate education by identifying the dimensions or factors which are currently used by graduate faculty in their evaluation of graduate students. These graduate student evaluation factors, because of the way in which they were produced, could be used as the framework of competencies desired in a competency-based system of graduate education.

The purpose of this study was to facilitate the formulation and clarification of educational objectives and the development of criteria for the evaluation of these objectives at the graduate level.

The research had three major objectives. The first objective was to identify the factors which are used by graduate faculty in their evaluation of graduate students. The second objective was to assess the differences between the scholarly divisions of the humanities, the biological sciences, the physical sciences, and the social sciences, in the factors used by the graduate faculty in their evaluation of graduate students. The third objective was to assess the differences between the professorial ranks of assistant professor, associate professor, and full professor, in the factors used by the graduate faculty in their evaluation of graduate students.

The research instrument was developed especially for this research by the investigator, building on the conceptual frameworks of behavioral objectives and performance rating. Interviews with forty-nine graduate faculty generated 816 behavioral statements representing the performance domain of the graduate student. The investigator empirically categorized these 816 statements and selected 98 representative statements for inclusion in the research instrument.

The graduate faculty in the scholarly divisions of the humanities, the biological sciences, the physical sciences, and the social sciences were selected as the population of interest for this research. The graduate faculty in the selected departments at Kansas State University were asked to indicate on a five-point scale on the instrument which behaviors of graduate students were important in their evaluation of their graduate students and which behaviors were not important in their evaluation. A total of 190 graduate faculty responded to the research instrument.

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To analyze the data, the Biomed BMD-X-72 factor analysis program was employed, using a Pearson Product Moment Correlation Matrix. Based on the oblimin criterion and with the factors restricted to be orthogonal, a varimax rotation was performed. Interpretation was based on the rotated factor loading matrix. A limit of twenty factors was imposed upon the program.

Twenty factors were identified which are used by these graduate faculty in their evaluation of graduate students. These factors were named as follows: Personal and Interpersonal Development, Analysis and Synthesis, Scholarly Productivity, Persistence, Communication, Research Methods and Equipment, Self Confidence, Professional Values, Initiative and Independence, Foreign Language, Independent Research, Conscientiousness, Evaluation, Musical and Artistic Competencies, Teaching, Conformity versus Creativity, Specialization, Knowledge, Questioning, and Method versus Experimentation.

Table One presents the twenty factors, their related statistics, and the three performance specimens which loaded highest on each factor.

A two-dimensional analysis of variance using unweighted means analysis compared the responses by scholarly division and by professorial ranks. Significant differences were identified between the scholarly divisions on nine of the twenty factors used by graduate faculty in their evaluation of graduate students. In contrast, on only two of the factors were significant differences identified between the three professorial ranks of assistant professor, associate professor, and full professor. For one factor, Scholarly Productivity, interaction between the scholarly divisions and the professorial ranks was found to be significant at the .05 level. A simple analysis of variance was completed for this factor.

A brief discussion of the first six factors follows.

The first factor, Personal and Interpersonal Development, accounted for 22% of the total variance. Significant differences were identified between the scholarly divisions on Factor One. The unweighted mean for the social sciences graduate faculty was positive, indicating a positive response to Personal and Interpersonal Development, while the unweighted mean for the graduate faculty in the physical sciences was moderately negative, indicating a negative response to this factor in evaluation. The unweighted means for the humanities and for the biological sciences were slightly positive and slightly negative, respectively, falling between the unweighted means of the other two divisions.

The second factor, accounting for 6.5% of the variance, was named Analysis and Synthesis. Significant differences were identified between professorial ranks on this factor. Assistant professors produced a negative unweighted mean, and associate professors and full professors produced positive unweighted means. Apparently assistant professors do not value the behaviors comprising Analysis and Synthesis and associate and full professors do consider them slightly important in their evaluation of graduate students.

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The third factor, Scholarly Productivity, accounted for 4.4% of the variance. The simple analysis of variance which was completed for the simple effects of the scholarly divisions revealed no significant differences within three of the divisions: the biological sciences, the physical sciences, and the social sciences. However, within the humanities division, there were significant differences between the professorial ranks. Full professors were very close to neutral in their unweighted mean on Scholarly Productivity while the unweighted mean of assistant professors was negative and that of associate professors was strongly negative on this factor. Associate professors in the humanities appear to reject the behaviors of Scholarly Productivity for their graduate students.

The simple analysis of variance which was completed for the simple effects of the professorial rank variable on Scholarly Productivity revealed no significant differences between the full professors, but did reveal significant differences between the assistant professors by scholarly division and between the associate professors by scholarly division on Scholarly Productivity.

Assistant professors in biological sciences produced a very high positive unweighted mean and assistant professors in physical sciences, also a positive unweighted mean. Social sciences' assistant professors produced a slightly negative unweighted mean and assistant professors in humanities, a very strongly negative unweighted mean.

Among associate professors, the physical sciences division produced an unweighted mean which was moderately positive, the biological sciences and the social sciences, slightly positive unweighted means, and the humanities, a very strong negative unweighted mean, on this factor of Scholarly Productivity.

The fourth factor, Persistence, did not produce any significant differences between the scholarly divisions nor between the professorial ranks.

Communication was the fifth factor and it did not produce any significant differences between the scholarly divisions nor between the professorial ranks.

On the sixth factor, Research Methods and Equipment, the scholarly divisions were significantly different. The biological sciences graduate faculty produced an unweighted mean which was strongly positive. Apparently these faculty really value the behaviors associated with mastery of research methods and equipment. The unweighted mean for the physical sciences graduate faculty was slighrly negative and the unweighted means of the social sciences and the humanities were moderately negative. No scholarly division valued Research Methods and Equipment very highly except biological sciences.

A discussion of each of the remaining factors is beyond the scope of this paper. Instead, the factors on which significant differences were identified between the scholarly divisions and between the professorial ranks are summarized in tables.

Table Two lists the nine factors to which the scholarly divisions responded in significantly different ways. The unweighted means show the magnitude and direction of the differences.

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Table Three indicates the two factors on which significant differences between the professorial ranks were identified, using the unweighted means to show the relative positions of assistant professors, associate professors, and full professors, on Analysis and Synthesis, and Questioning.

A direct comparison of the four scholarly divisions can be made in two ways, first, using only the nine factors on which differences between the divisions appeared, and second, using all twenty of the factors identified by this research.

Table Four enables a direct examination of the differences between the scholarly divisions, with the nine factors ranked in order of their unweighted means by scholarly division. The nine factors were cleanly divided among the divisions with only one factor highly valued by more than one division. All but one of these nine factors was highly rated by some division; the exception was the factor of Teaching, which was not valued highly by any scholarly division.

The humanities division highly valued the factors of Musical and Artistic Competencies, Foreign Language, and Specialization, and were slightly positive on Personal and Interpersonal Development.

The biological sciences graduate faculty were strongly positive on Research Methods and Equipment, Independent Research, and Scholarly Productivity and were slightly positive on Evaluation and Specialization.

The physical sciences valued Scholarly Productivity above all other factors and were slightly interested in the factors of Foreign Language and Independent Research.

The two factors that the social sciences graduate faculty thought significant for use in evaluation of their graduate students were Evaluation and Personal and Interpersonal Development.

Using all twenty factors identified by this research, profiles of the desired characteristics of graduate students in each of the four scholarly divisions can be produced. These profiles are presented in Tables Five through Eight. The profiles for each division were derived by ranking in order, from highly positive to highly negative, the unweighted means of each of the factors derived from the graduate faculty for that division.

To the degree that the factors were valued by the graduate faculty in a scholarly division in their evaluation of graduate students, as reflected in the positive unweighted means, the factors represent the competencies or areas of performances desired for the graduate student of that division by its graduate faculty. The factors with negative unweighted means are competencies which are not valued nor desired in graduate students by the graduate faculty in that scholarly division.

The twenty factors are intended to serve as a framework of desired outcomes for graduate education. The performance specimens associated with each of the factors could be translated into behavioral objectives and thus provide a means of evaluating the attainment of these competencies.

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No claim is made that these twenty factors are the only desired outcomes of graduate study. Every department and faculty member could add his own to this listing. The importance of this research is in providing the framework within which a consideration and specification of the desired outcomes of graduate education might take place.

The major limitation of this research was that the population was drawn from only one university. A replication of this research design with graduate faculty from several universities stratified by region, size, and type of control would be the logical next step following this research.

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TABLE ONE.
FACTORS IN GRADUATE FACULTY EVALUATION OF GRADUATE STUDENTS

		Percent Variance Acct.For	Total Variance Acct.For	Eigen-values
1.	PERSONAL AND INTERPERSONAL DEVELOPMENT	22.928	22.928	22.470
+0.813	Demonstrated that he cared about other individuals by asking about their feelings, interests, and ideas and by listening when they talked			
+0.708	Volunteered for responsibilities in faculty projects or departmental activities which interested him			
+0.691	Developed interpersonal skills and a sensitivity to other persons			
2.	ANALYSIS AND SYNTHESIS	6.507	29.435	6.377
-0.683	Analyzed problems into their component parts and then integrated the parts again logically			
-0.662	Recognized on his own a unifying principle or idea in his research data or tentatively related an unusual research finding to theory and worked out possible causes and implications			
-0.579	Developed and refined his problem-solving skills, e.g., identifying relevant data, stating assumptions, and limitations, etc.			
3.	SCHOLARLY PRODUCTIVITY	4.447	33.882	4.357
+0.798	Published a paper in a professional publication			
+0.680	Took every available opportunity to present papers and to give seminars			
+0.632	Attended professional meetings at the regional or national level and presented papers, if possible			

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TABLE ONE, continued.
FACTORS IN GRADUATE FACULTY EVALUATION OF GRADUATE STUDENTS

		Percent Variance Acct.For	Total Variance Acct.For	Eigen-values
4.	PERSISTENCE	3.468	37.350	3.398
-0.769	Worked constantly on discipline-related work, spending days, evenings, and weekends immersed in his work			
-0.609	Directed his activities, in class and out, toward reaching his goals for graduate study, including completion of his degree program			
-0.346	Did the assigned work, exactly as it was assigned			
5.	COMMUNICATION	3.088	40.438	3.027
-0.729	Mastered the technical aspects of writing, including the use of correct grammar, the appropriate level of formality, footnoting and preparation of bibliographies			
-0.673	Produced written work which was simply, clearly, and fluently written, characterized by unity, balance, and precision			
-0.582	Searched through the literature as a source of solutions to problems			
6.	RESEARCH METHODS AND EQUIPMENT	2.532	42.970	2.481
-0.750	Learned how to use and take care of laboratory equipment and instruments			
-0.690	Maintained scrupulously correct research procedures and techniques, constantly examining his materials and his equipment			
-0.610	Mastered the technical skills required in his discipline, such as the use of laboratory equipment, the manipulation of materials, or the playing of a musical instrument			

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TABLE ONE, continued
FACTORS IN GRADUATE FACULTY EVALUATION OF GRADUATE STUDENTS

		Percent Variance Acct.For	Total Variance Acct.For	Eigen-values
7.	SELF CONFIDENCE	2.202	45.172	2.158
+0.737	Valued his own ideas and judgment as much as he valued the ideas and judgment of the faculty member and therefore approached his faculty members as colleagues			
+0.488	Enjoyed learning for its own sake			
+0.482	Distinguished between criticism of an idea or a project and criticism of himself			
8.	PROFESSIONAL VALUES	2.158	47.330	2.115
+0.636	Demonstrated in his behavior strong commitments to professional standards and values			
+0.551	Identified himself with the profession and presented himself as a professional			
+0.319	Directed his activities, in class and out, toward reaching his goals for graduate study, including completion of his degree program			
9.	INITIATIVE AND INDEPENDENCE	1.985	49.315	1.946
-0.580	Chose his research topic from among the important problems in his discipline			
-0.567	Planned out his own program of studies, after considering his background and his goals for graduate study			
-0.410	Planned his daily work and carried it out on his own, needing little help from his faculty adviser or other graduate faculty members			

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TABLE ONE, continued
FACTORS IN GRADUATE FACULTY EVALUATION OF GRADUATE STUDENTS

		Percent Variance Acct.For	Total Variance Acct.For	Eigen-values
10.	FOREIGN LANGUAGE	1.910	51.225	1.872
+0.716	Learned a foreign language, worked at perfecting his language skills, and was able to function effectively in the language			
+0.332	Used an artistic technique which fit the subject material and the intended communication			
+0.308	Knew and used effective study techniques, such as taking good class notes, reviewing material, budgeting his time, etc.			
11.	INDEPENDENT RESEARCH	1.769	52.994	1.734
+0.636	Proceeded on his own in his research or in the investigation of a topic and solved the problems he encountere encountered by himself most of the time			
+0.610	Developed well planned and creative research projects on his own, formulating goals, defining questions clearly, and determining appropriate courses of action			
+0.455	Made an important contribution to the discipline through an original piece of research			
12.	CONSCIENTIOUSNESS	1.657	54.651	1.624
-0.694	Did more than was expected in fulfilling his responsibilities, e.g., in teaching, research, course work requirements, etc.			
-0.566	Worked to the limits of his capacity, whatever those limits were			
-0.424	Asked pertinent, perceptive questions about his field or about some object, event or phenomena he was studying			

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TABLE ONE, continued.
FACTORS IN GRADUATE FACULTY EVALUATION OF GRADUATE STUDENTS

		Percent Variance Acct.For	Total Variance Acct.For	Eigen-values
13.	EVALUATION	1.551	56.202	1.520
+0.606	Related facts and events to general and abstract statements			
+0.462	Analyzed material, taking into consideration the author's values and background and comparing it with ideas and information from other sources			
+0.408	Critically evaluated the worth of ideas, books and materials that he read			
14.	MUSICAL AND ARTISTIC COMPETENCIES	1.545	57.747	1.515
-0.728	Interpreted a particular musical work appropriately in terms of the composer's intention, the style and tradition of the music, and its historical period			
-0.483	Supplied his own equipment when necessary, either by building it or spending his own money to purchase it			
-0.444	Participated in university-wide activities, such as political groups, social organizations, musical activities, and/or graduate student programs			
15.	TEACHING	1.489	59.236	1.460
-0.765	As a teacher, he met with his undergraduate students and discussed their problems			
-0.709	As a teacher, he helped his students to question and to understand the material he was presenting			
-0.575	As a teacher, he planned educational experiences, both in the classroom and outside, which were directed toward particular educational objectives			

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TABLE ONE, continued.
FACTORS IN GRADUATE FACULTY EVALUATION OF GRADUATE STUDENTS

		Percent Variance Acct.For	Total Variance Acct.For	Eigen-values
16.	CONFORMITY VERSUS CREATIVITY	1.428	60.664	1.399
+0.744	Made "A's" in his major and related courses			
+0.406	Did the assigned work, exactly as it was assigned			
-0.383	Did creative work, whether it was composing music, producing art, or writing a form of literature or a creative paper			
17.	SPECIALIZATION	1.393	62.057	1.366
-0.463	Identified his own unique skills and abilities and developed his specialty based on those strengths			
-0.353	Produced results in his work regularly and often more quickly and efficiently than expected			
-0.334	Mastered the technical skills required in his discipline, such as the use of laboratory equipment, the manipulation of materials, or the playing of a musical instrument			
18.	KNOWLEDGE	1.309	63.366	1.282
-0.710	Demonstrated a basic background in the relevant subject areas for graduate study in his field			
-0.503	Mastered the content of his subject area(s)			
-0.419	Presented ideas in an organized way			

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TABLE ONE, continued.
FACTORS IN GRADUATE FACULTY EVALUATION OF GRADUATE STUDENTS

		Percent Variance Acct.For	Total Variance Acct.For	Eigen-values
19.	QUESTIONING	1.274	64.640	1.249
+0.704	Challenged faculty members' statements which were unclear or not well supported			
+0.592	Discussed ideas, issues, and problems with his faculty regularly			
+0.543	Risked revealing his ignorance or lack of understanding in order to learn by asking questions or by trying out ideas, approaches, or experiments, even when he was uncertain of their value or outcome			
20.	METHOD VERSUS EXPERIMENTATION	1.251	65.891	1.226
+0.597	Wrote down ideas generated from class or research activities			
+0.367	Attended graduate seminars, departmental colloquia, speaker programs, or musical events voluntarily			
+0.363	Knew and used effective study techniques, such as taking good class notes, reviewing material, budgeting his time, etc.			

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TABLE TWO. SIGNIFICANT DIFFERENCES BETWEEN THE SCHOLARLY DIVISIONS ON NINE FACTORS using the unweighted means for each division for each factor.

Factor	Humanities	Biological Sciences	Physical Sciences	Social Sciences
1. Personal and Interpersonal Development	+0.13	-0.15	-0.26	+0.28
3. Scholarly Productivity	-0.69	+0.27	+0.31	-0.10
6. Research Methods and Equipment*	-0.24	+0.73	-0.04	-0.32
10. Foreign Language	+0.47	-0.23	+0.10	-0.22
11. Independant Research	-0.09	+0.38	+0.06	-0.25
13. Evaluation	-0.21	+0.15	-0.39	+0.40
14. Musical and Artistic Competencies*	+0.63	-0.05	-0.25	-0.05
15. Teaching*	-0.09	-0.03	-0.31	-0.30
17. Specialization*	+0.51	+0.13	-0.31	-0.04

TABLE THREE. SIGNIFICANT DIFFERENCES BETWEEN THE PROFESSORIAL RANKS ON TWO FACTORS using the unweighted means for each division for each factor.

Factor	Assistant Professor	Associate Professor	Full Professor
2. Analysis and Synthesis*	-0.11	+0.07	+0.03
19. Questioning	+0.26	-0.30	+0.10

*Signs on these factors have been reversed to preserve their true values. The items loading on these factors were negative, resulting in negative factors. The signs were changed rather than work with negatively named factors.

TABLE FOUR. THE NINE FACTORS, WHICH WERE SIGNIFICANTLY DIFFERENT, BETWEEN THE DIVISIONS, arranged in order of unweighted means by scholarly division.

HUMANITIES	BIOLOGICAL SCIENCES	PHYSICAL SCIENCES	SOCIAL SCIENCES
	+0.73 Research Methods		
+0.63 Musical & Art			
+0.51 Specialization			
+0.47 Foreign Language			
			+0.40 Evaluation
	+0.38 Indep.Research		
		+0.31 Schol.Product.	
			+0.28 Person.Interper.
	+0.27 Schol.Product.		
	+0.15 Evaluation		
+0.13 Person.Interper.	+0.13 Specialization		
		+0.10 Foreign Language	
		+0.06 Indep.Research	
	-0.03 Teaching		
	-0.05 Musical & Art	-0.04 Research Methods	-0.04 Specialization
-0.09 Indep.Research			-0.05 Musical & Art
-0.09 Teaching			-0.10 Schol.Product.
	-0.15 Person.Interper.		
-0.21 Evaluation			-0.22 Foreign Language
-0.24 Research Methods	-0.23 Foreign Language	-0.25 Musical & Art	-0.25 Indep.Research
		-0.26 Person.Interper.	
		-0.31 Teaching	-0.30 Teaching
		-0.31 Specialization	-0.32 Research Methods
		-0.39 Evaluation	
-0.69 Schol.Product.			

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TABLE FIVE. PROFILE OF HUMANITIES GRADUATE STUDENT
Competencies desired by humanities graduate faculty, all factors, ranked in order by their unweighted mean for humanities faculty.

+0.63 Musical and Artistic Competencies

+0.51 Specialization
+0.47 Foreign Language

+0.25 Persistence
+0.22 Professional Values

+0.16 Conscientiousness
+0.13 Initiative and Independence
+0.13 Personal and Interpersonal Development

+0.07 Communication
+0.04 Self Confidence
+0.02 Questioning
-0.00 Conformity and Creativity
-0.04 Analysis and Synthesis
-0.05 Method versus Experimentation
-0.08 Knowledge
-0.09 Independent Research
-0.09 Teaching

-0.21 Evaluation

-0.24 Research Methods

-0.69 Scholarly Productivity

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TABLE SIX. PROFILE OF BIOLOGICAL SCIENCES GRADUATE STUDENT
Competencies desired by biological sciences graduate faculty, all factors, ranked in order by their unweighted mean for biological sciences graduate faculty.

+0.73	Research Methods
+0.28	Independent Research
+0.27	Scholarly Productivity
+0.17	Questioning
+0.15	Self Confidence
+0.15	Evaluation
+0.13	Specialization
+0.09	Method versus Experimentation
+0.06	Knowledge
+0.01	Analysis and Synthesis
0.00	Conformity versus Creativity
-0.03	Teaching
-0.05	Musical and Artistic Competencies
-0.07	Initiative and Independence
-0.07	Persistence
-0.11	Communication
-0.15	Personal and Interpersonal Development
-0.15	Conscientiousness
-0.19	Professional Values
-0.23	Foreign Language

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TABLE SEVEN. PROFILE OF PHYSICAL SCIENCES GRADUATE STUDENT
Competencies desired by physical sciences graduate faculty, all factors, ranked in order by their unweighted mean for physical sciences graduate faculty.

+0.31 Scholarly Productivity

+0.15 Analysis and Synthesis
+0.13 Knowledge
+0.10 Persistence
+0.10 Foreign Language

+0.06 Independent Research
+0.01 Conscientiousness
-0.02 Method versus Experimentation
-0.03 Initiative and Independence
-0.04 Questioning
-0.04 Research Methods
-0.09 Conformity and Creativity

-0.15 Self Confidence
-0.17 Professional Values
-0.19 Communication

-0.25 Musical and Artistic Competencies
-0.26 Personal and Interpersonal Development

-0.31 Specialization
-0.31 Teaching

-0.39 Evaluation

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TABLE EIGHT. PROFILE OF SOCIAL SCIENCES GRADUATE STUDENT
Competencies desired by social sciences graduate faculty, all factors, ranked in order by their unweighted means for social sciences graduate faculty.

+0.40 Evaluation

+0.28 Personal and Interpersonal Development
+0.26 Communication

+0.22 Professional Values

+0.09 Conformity and Creativity
+0.06 Initiative and Independence
+0.03 Self Confidence
-0.01 Method versus Experimentation
-0.04 Conscientiousness
-0.04 Specialization
-0.05 Musical and Artistic Competencies
-0.08 Questioning
-0.10 Scholarly Productivity

-0.13 Knowledge
-0.14 Analysis and Synthesis

-0.22 Foreign Language
-0.23 Persistence
-0.25 Independent Research

-0.30 Teaching
-0.32 Research Methods